

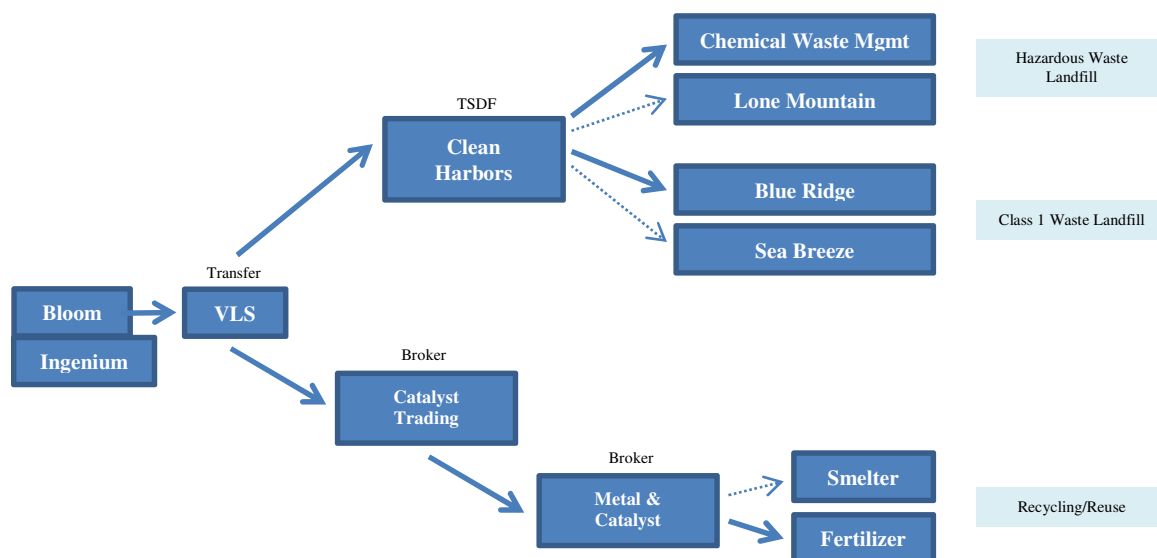
Subject: Bloom Energy- Additional information for December 2, 2015 meeting

1. How does Bloom determine when the filter material in the desulfurization units (Desulf Units) needs to be replaced? For the facilities in Delaware, how frequently (for example, after how many hours of usage) are Desulf Units removed and replaced?
 - Desulfurization Units are replaced as proactive preventive maintenance with the objective of installing units with new filters before the existing filters experience a decline in effectiveness. The main driver for replacement is to maintain maximum performance of the Energy Server.
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 - The life expectancy of a filter is a function of various factors including inherent filter material properties, gas quality (and contaminants), and gas flow, among others.
 - Bloom uses two types of filters. One type, manufactured by UniCat is replaced every 6 months. The second type, manufactured by Clariant, was being replaced every nine months, but we have now determined that a 12 month or longer replacement cycle is sufficient.
 - In about 85 -90% of cases, the filters have an estimated 10% or more of run time left when the canister is removed from service. In the remaining units, Bloom monitoring of Energy Server performance indicates that the filters have less than 10% of run time remaining at the time of replacement.
 - Bloom follows the above maintenance and replacement strategy in Delaware and wherever it does business.
2. In documents provided to the Delaware Department of Natural Resources and Environmental Control (DNREC) in March, 2015, Bloom indicated that three Desulf Units are installed and operated in series, with a fourth installed as a “back-up.” Bloom also indicated that all four Desulf Units are simultaneously removed from service at the Delaware facilities before the filters have been used to capacity. Please quantify how “used” the filter material in each of the four Desulf Units is upon removal from service.
 - As described in response to question 1, almost all replacements are proactive preventive maintenance.
 - As such, the 4th “back-up” Unit has not seen any gas flow. As a result, Bloom typically replaces three canisters (Nos. 1-3) and the “back-up” No. 4 canister is re-used in position 1 while positions 2-4 receive new Units.
 - In situations when there has been some gas flow to the “back-up” unit, it will either be re-used in position 1 or replaced – a decision typically made in the field.
 - As explained in response to question #1, in 85-90% of replacements, the filter has about 10% or more of life run-time left. The remaining filters have less than 10% run time remaining. Bloom does not undertake a precise quantification of how “used” the filters are.

3. Bloom tested Desulf Unit filters removed from service at each of the four Delaware sites and provided those test results to DNREC in March, 2015. What other analytical data does Bloom have about the amount of benzene and/or metals present in the used filter materials?
 - The only analytical data on the contents of desulfurization units, as shipped, are the test results referenced above and attached to the March 12, 2015 letter to DNREC.
4. Please describe Bloom's process knowledge regarding the amount of benzene and/or metals present in the used filter materials at the point when Desulf Units are disconnected from the Energy Server.
 - Please see the answers to questions 1-3 above.
5. In documents provided to DNREC in 2014, Bloom indicated that used filter material can be: burned for energy recovery; reclaimed for copper; used in cement manufacturing; and/or landfilled.
 - a. Which chemical components (e.g., sulfur, metals, activated carbon, etc.) of the used filter material are managed by each of these methods?
 - Bloom Desulfurization Units are transported to VLS-BAYPORT in Pasadena, Texas. VLS is licensed by the Texas Commission on Environmental Quality as a transfer facility. VLS opens the units, and separates the materials into two streams:
 - o **Reclamation:** The copper carbonate (CuCO_3) fraction of the desulf materials is set aside for reclamation/recycling.
 - o **Disposal:** The remaining filter materials are packaged and transported, under a manifest, for treatment and disposal at a hazardous waste TSDF.

What proportion of all of the used filter material that has been shipped from Delaware has been managed by each method? For any used filter material that is managed by more than one method, please identify which methods and the order in which they occur.

- All of the copper carbonate material is managed as described above, and is set aside for reclamation/recycling. It typically makes up more than 20% of the filter materials. The remaining filter materials are packaged and manifested for transportation to a hazardous waste TSDF.
- b. In the documents provided in 2014, Bloom indicated that Clean Harbors manages the used filter material according to at least one of these methods. Please provide the names of any other facilities involved in the recovery, reclamation, or reuse of used filter material.
 - The flowchart below contains the names of all facilities Bloom is aware of that are involved in the recovery, reclamation, reuse, or disposal of used filter materials.



6. In documents provided to DNREC in March, 2015, Bloom indicated it anticipated 1) transferring the operation of refilling empty Desulf Units with fresh filters to the Delaware manufacturing plant; 2) introducing Energy Servers for residential use; and 3) developing a plan for testing material removed from Desulf Units so that non-hazardous material can be managed accordingly. Which, if any, of these programs have been introduced or implemented?

- 1. Bloom today fills 100% of all its North American Desulfurization Unit canisters at the Delaware Manufacturing Plant. The transfer process plan was started in Sept 2014, the facility was set up in January 2015, first tests were run in February 2015 and production ramp-up started in April 2015.
- 2. No date has yet been set for the introduction of Bloom residential use Energy Servers.
- 3. The March 12, 2015 letter to DNREC, bloom explained at pages 14-17 that, because a majority of the test results from Delaware were not hazardous, *if* Desulfurization Units were subject to regulation *before* they are opened, it would be economically rationale for Bloom to test these on site and then have them transported by a hazardous waste shipper only if they actually exceed RCRA hazard limits. DNREC's conclusion that the MPU Exemption applies to the Desulfurization Units makes such in the field testing unnecessary – a result which better serves environmental objectives, as explained in the March 12 letter.

7. Bloom Energy has indicated that it is operating in 10 states, including California. Please provide documents that reflect any determination by the State of California, or other states, regarding the regulatory status of Bloom's spent filter material.
- No state other than Delaware has ever raised a concern regarding Bloom's handling of used filters within Desulfurization Units before those Units are opened and the filters are removed. Accordingly, there are no documents, other than the determination by the secretary of DNREC.